Energy in Commercial Appraisals and Mortgages: Risk or Reward?

May 16, 2017

3:45 – 5:00 PM

Agenda

- Opening remarks – David Nemtzow
- Impact of energy on default risk in commercial mortgages *(~25 mins)*
  - Paul Mathew, Lawrence Berkeley National Laboratory
  - Nancy Wallace, UC Berkeley Haas School of Business
- Appraising green buildings *(~15 mins)*
  - Andrew White, JDM Associates
- Discussion *(~30 mins)*

Energy and default risk in commercial mortgages

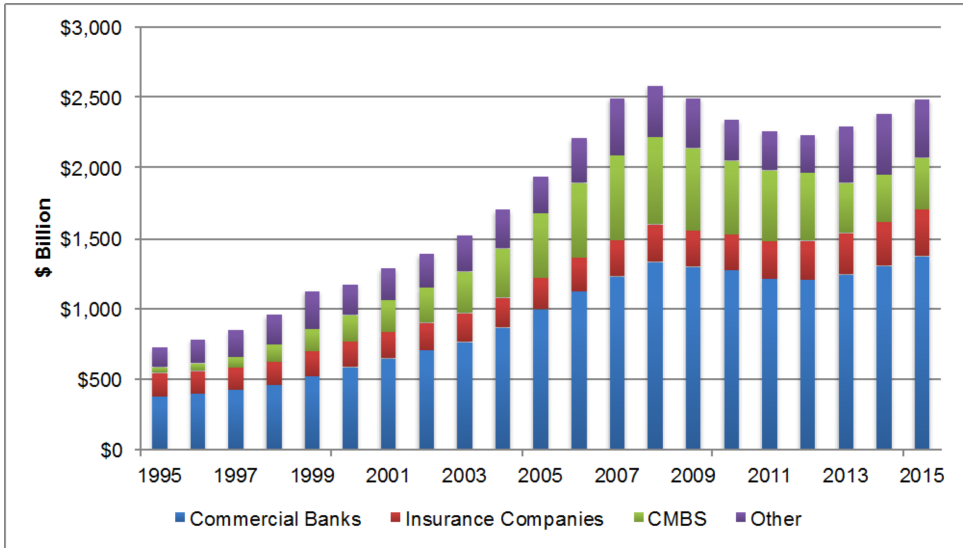
Paul Mathew Lawrence Berkeley National Lab

Nancy Wallace University of California, Berkeley

What about commercial mortgages?

Commercial mortgages currently do not fully account for energy factors in underwriting and valuation…

…energy efficiency is not properly valued and energy risks are not properly assessed and mitigated.



Commercial mortgages are a large lever and could be a significant channel for scaling energy efficiency.

The link between energy and valuation

Energy directly affects Net Operating Income (NOI) used in valuation.

Energy Use Volume
Electricity kWh/kW, fuel therms, etc.
Driven by bldg. features, operations, climate

Energy Price
$/kWh, $/kW, $/therm
Set by rate structure

Energy Use Volatility
+/- change over mortgage term
Driven by bldg operations, weather variation

Energy Price Volatility
+/- change over mortgage term
Driven by rate structure, forward price curves

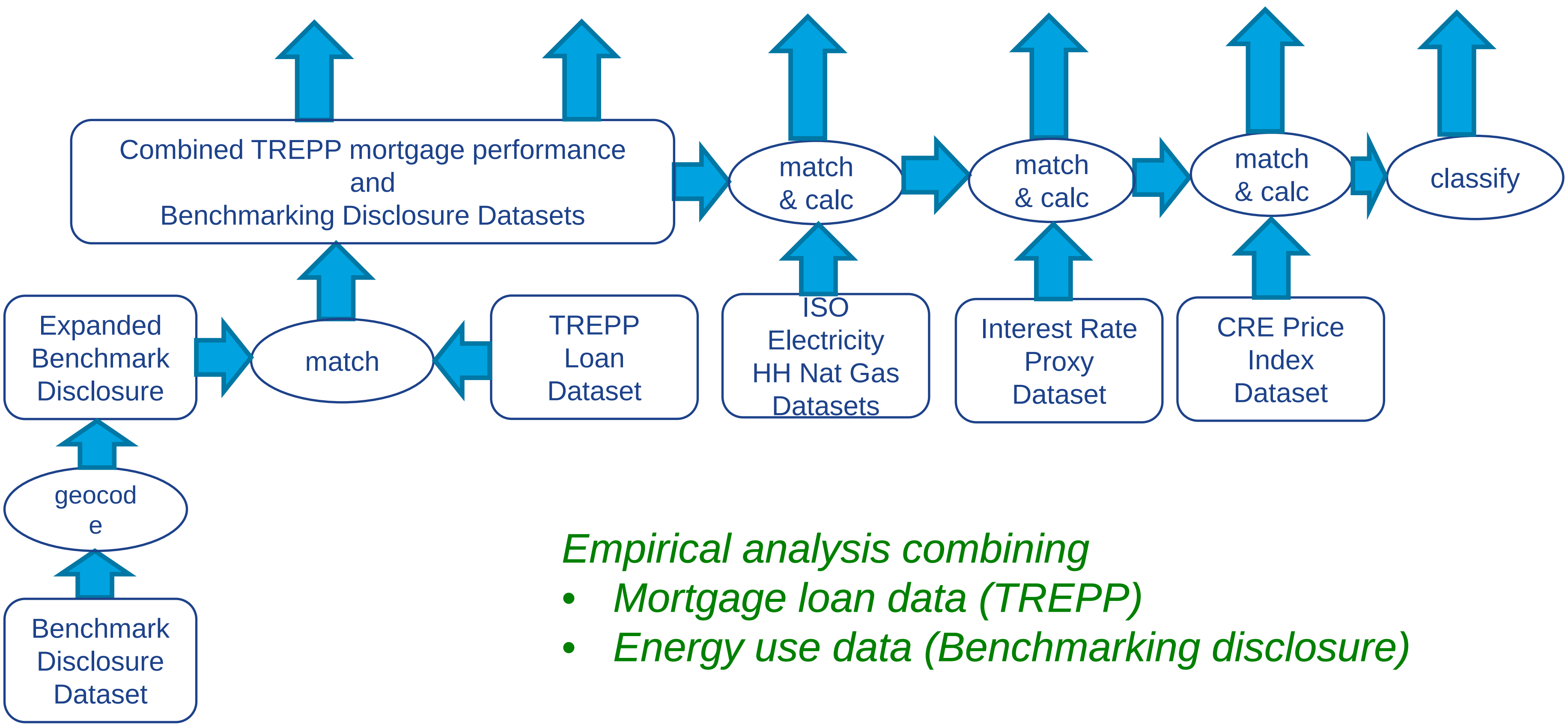
Current practice does not fully account for these factors in calculation of Net Operating Income (NOI)

- Usually based on historical average cost data, if available
- Does not account for energy use and price volatility during mortgage term

Key question: How much do these factors "move the needle" for NOI and default risk?

Approach: Impact of energy on default rate

Mortgage Default Rate = *f* (EUI, ElecPriceGap, CouponSpread, LTV, Region)



Empirical analysis combining

- *Mortgage loan data (TREPP)*
- *Energy use data (Benchmarking disclosure)*

Default risk and source EUI: Office and Retail – Linear probability model

	Coefficient Estimate	Standard Error
Intercept	-0.40444**	0.18466
Log Source EUI	0.07335**	0.03129
Origination Loan-to-Value Ratio	0.00258***	0.00096
Coupon Spread to 10 Year Treasury	0.02188	0.01565
Electricity Price Gap	0.00003***	0.00001
Time to Maturity on Balloon	-0.00189***	0.00060
Origination Year Fixed Effects	Yes	
	N = 473 R2 = .1052	

* p<0.1; ** p<0.05; ***p<0.01

Default risk and source EUI: Office and retail – linear prob. model

- The coefficient estimates for **BOTH** the *Electricity Price Gap* and *Source EUI* are significant at better than the .05 level of statistical significance.
- **Both** coefficient estimates are also economically meaningful:
  - The higher the ***Source EUI*** (the more energy usage per square foot) the higher the likelihood of default.
  - The higher the ***Electricity Price Gap***, (the larger the difference between the actual and the expected electricity prices since the loan origination), the higher the likelihood of default.

What are the impacts on specific cases? – Scenario analysis

- Develop range of scenarios that have different energy factor risks
  - Range of locations, building features, operations, etc.

For each scenario:

- Determine energy consumption and price volatility.
  - Use combination of empirical and simulation approaches
- Use hazard model coefficients to determine impact on default risk

Asset types

Use	Size	Climate	Asset eff	ASHRAE 90.1 (approx)
Office	500,000	4A (Baltimore)	High	2013
Office	500,000	4A (Baltimore)	Medium	2004
Office	500,000	4A (Baltimore)	Low	2004 w/ pre-1980 env.
Office	500,000	2A (Houston)	High	2013
Office	500,000	2A (Houston)	Medium	2004
Office	500,000	2A (Houston)	Low	2004 w/ pre-1980 env.
Office	200,000	4A (Baltimore)	Medium	2004
Office	25,000	4A (Baltimore)	Medium	2004
…				

A wide range of operational factors affect year-to-year energy use variations

Facilities management

Economizer settings

VAV box minimum flow setting

Supply air temperature reset

Static pressure reset

Chilled water/Hot water supply temperature reset

Condenser water temperature reset

Chiller /boiler sequencing

…

Weather

Vacancy rates

Occupant behavior

Lighting controls

Window operation

Thermostat setpoints/setback

Local heating/cooling equipment

Plug in equipment

Maintenance

Damper/ valve check

Filter change

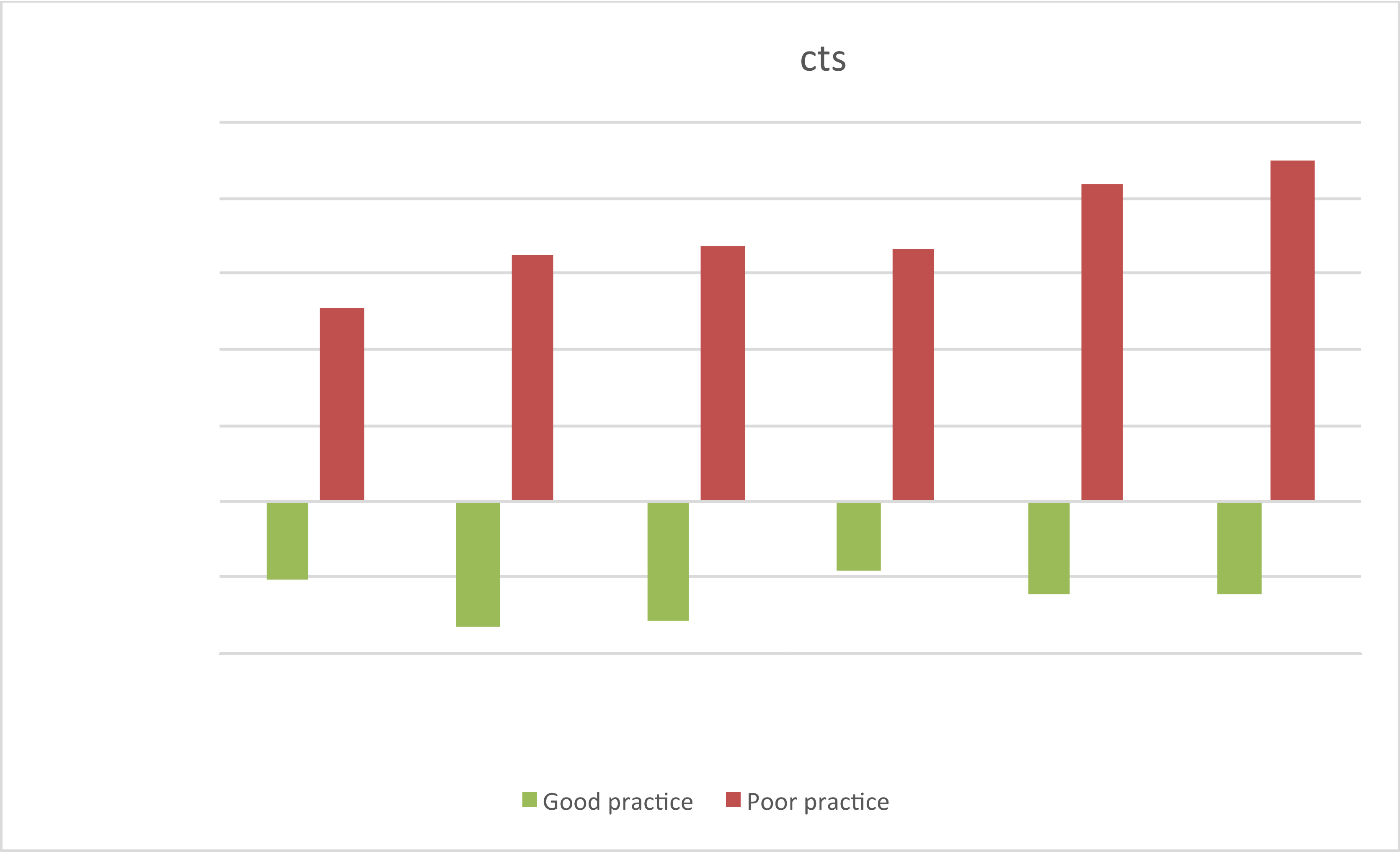
Coil cleaning

…

Range of practice for each operation factor

Factor	Good practice	Average practice	Poor practice
Lighting controls	Daylight-dimming + occ	Occ only	Timer only
Plug load controls	Turn off when occupants leave	Sleep mode by itself	No energy saving measures
HVAC schedule	optimal start	2hr +/- Occupanct sch	n/a
Thermostat settings	68°F for heating and 78°F for cooling Setback: 60 - 85	70°Ffor heating and 76°F for cooling Setback: 68 - 80	72°F for heating and 74°F for cooling No setback
Supply air temp reset	SAT reset base on warmest zones	SAT reset based on the stepwise function of outdoor air temperature	Constant supply air temperature
VAV box min flow settings	15% of design flow rate.	30% of design flow rate.	50% of design flow rate.
Economizer controls	Enthalpy	dry bulb	none/broken
Chilled water supply temp reset	Reset chilled water temperature based on cooling demand.	Linear relationship with outside air temp (OAT).	No reset with constant year-round.
Chiller sequencing	Kick on the lag chiller when the lead chiller reaches its peak efficiency.	Kick on the lag chiller when the chilled water temperature cannot be maintained.	Always running two chillers
Hot water supply temp reset	Reset the hot water supply temperature according to heating load.	Linear relationship with OAT.	No reset with constant year-round.
Boiler sequencing	Kick on the lag boiler when lead boiler reaches its peak efficiency.	Kick on the second boiler based on OAT.	No sequencing and always running two boilers.
Plug load intensity	0.4 W/sf	0.75 W/sf	2.0W/sf
Occupant density	400 sf/per	200 sf/per	130 sf/per
Occupant schedule	8 hour WD	12 Hr WD	16 Hr WD

Range of variation due to operation factors



Impact on default risk – scenario analysis

Case	Source EUI change from basecase (%)	Source EUI (kBtu/sf.yr)	Default risk change (basis points)	Default risk change from TREPP avg (%)
2A Baseline	-	172	**-**	-
2A Poor practice	+32.5%	228	**+90**	+11.2%
2A Good practice	-16.5%	144	**-57**	-7.2%
2A Low asset efficiency	+0.8%	173	**+3**	+0.3%
2A High asset efficiency	-20.3%	137	**-72**	-9.0%
2A Weather 2001-15 high	+1.4%	174	**+4**	+0.6%
4A Baseline	-	169	**-**	-
4A Poor practice	+41.7%	239	**+111**	+13.9%
4A Good practice	-12.2%	148	**-41**	-5.2%
4A Low asset efficiency	+2.1%	173	**+7**	+0.8%
4A High asset efficiency	-15.6%	143	**-54**	-6.7%
4A Weather 2001-15 high	+0.8%	170	**+3**	+0.3%

Pilot projects

Collaborate with lenders to:

1. Demonstrate impact of energy use and price on specific mortgage loans

2. Develop recommendations

COLORADO LENDING SOURCE

NORTHMARQ CAPITAL

Silicon Valley Bank

Approach

- Compile info from Appraisals, PCAs, other sources.
- Estimate source EUI variations.
  - Simulation and empirical approaches
- Compute elec price gap using forward curves.
- Compute default risk impact due to source EUI and elec price gap.
- Publish pilot case study and recommendations.

Small office pilot: Energy use and default risk

preliminary results

Facilities Management factors:

- HVAC schedule
- Thermostat setback
- Supply air temp control
- VAV min flow control
- Economizer controls
- Lighting controls

Levels: good, avg, poor

Occupancy factors:

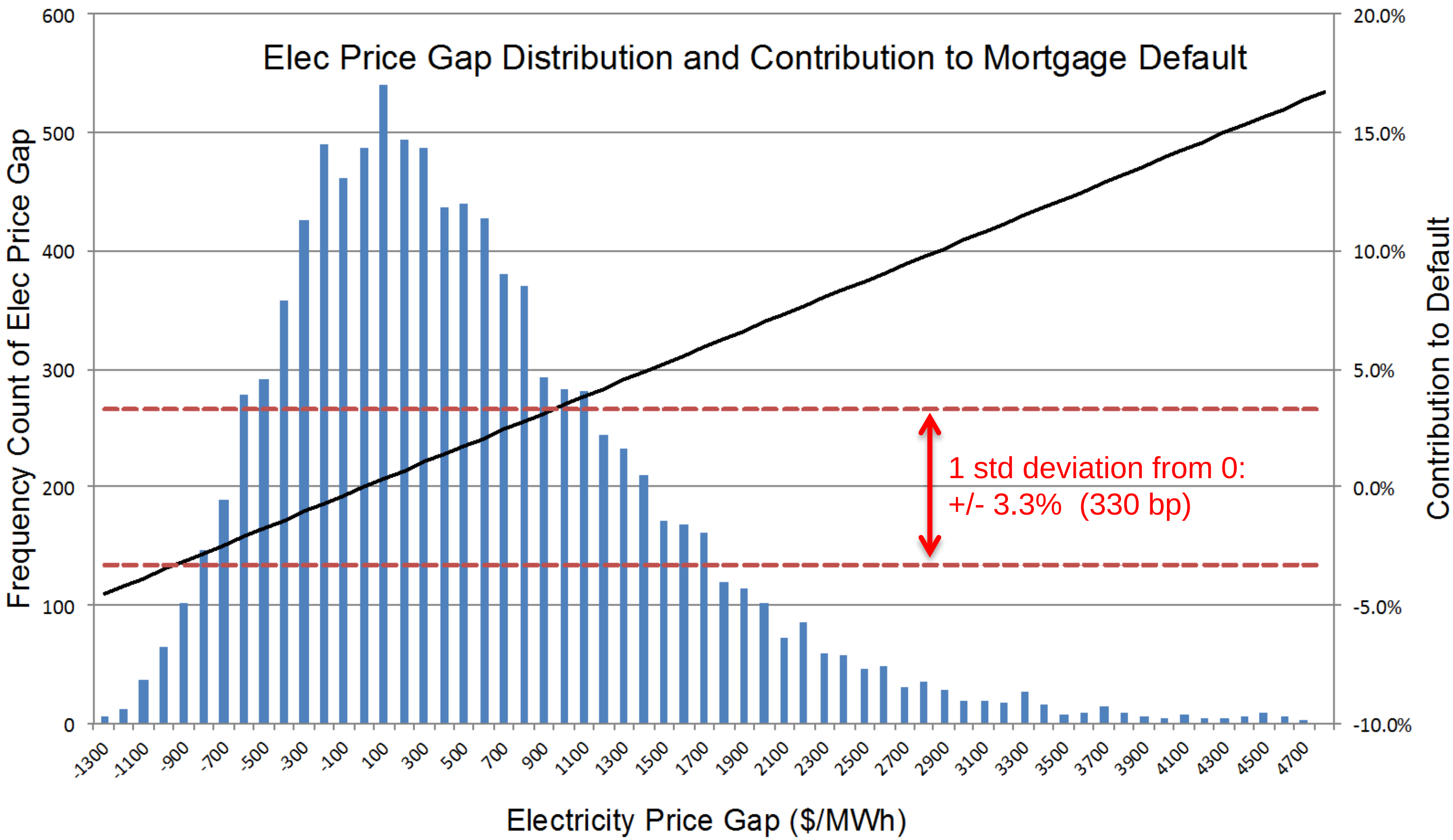
- Occupant density
- Occupant schedule
- Plug load density
- Plug load controls

Levels: good/low, avg, poor/high

Case	Fac mgmt factors Level	Occ Factors Level	Source EUI change (%)	Default risk change (bp)
1	Good	Good/Low	-54%	-248
2	Good	Ave	-33%	-127
3	Ave	Ave	-	-
4	Good	Poor/High	+4%	+12
5	Poor	Good/Low	+64%	+158
6	Poor	Ave	+76%	+181
7	Poor	Poor/High	+132%	+268

Small office pilot: Energy price and default risk

preliminary results



Looking ahead

Vision:

Energy factors are <u>fully and routinely</u> incorporated in commercial mortgage valuation, accelerating demand for buildings with lower energy risk.

Show that energy matters → Develop and pilot interventions → Broader deployment → Institutionalize

Year 1 — Analysis of energy impacts on mortgage valuation

Year 2 — Pilot case studies on actual mortgage loans

Year 3 — Best practices protocols for lenders and owners

Long term — Industry Standards

Actions you can take NOW

Lenders:

- Ask owners to provide information about energy cost risks.
  - Could be done as part of Property Condition Assessment

Owners:

- Ask lenders to account for energy efficiency when setting mortgage terms.
- Provide data on energy costs to lender.
  - Historical and anticipated
  - In appraisal and/or PCA

Please let us know if you would like to participate in this project!

Acknowledgements

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Appraising Green Buildings

Andrew White
JDM Associates

U.S. DEPARTMENT OF ENERGY

BUILDING
SUSTAINABILITY

Appraising Green Buildings

Andrew White, JDM Associates

May 16, 2017

JDM
ASSOCIATES

BUILDING SUSTAINABILITY

WE ARE DEDICATED PROFESSIONALS THAT STRIVE TO IMPROVE THE PERFORMANCE OF BUILDINGS — CREATING VALUE THROUGH ENERGY & RESOURCE MANAGEMENT, REAL ESTATE STRATEGY, AND CRAFTING TRANSFORMATIONAL PROGRAMS FOR OUR CLIENTS.

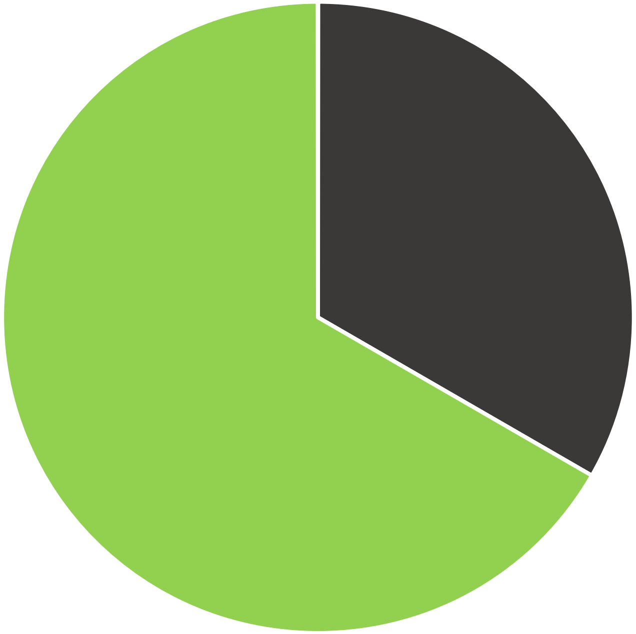
The Appraisal Process

1. Identify the Need for Appraisal and Valuation
2. Define Scope of Work
3. Collect Property Data and Information
4. Analyze Property Data and Information
5. Apply Approaches to Value
6. Reconcile Value and Provide Final Opinion
7. Submit final report

Barriers

- Regulatory and market changes that increase **commoditization** of appraisals
  - Little budget or reward for making “unusual” adjustments, even when warranted
  - Fragmented, aging, and skeptical appraisal workforce
  - Lack of confidence in addressing green buildings
- Poor **communication** of high-performance building features amongst owners, lenders, and appraisers
- Lack of relevant **education**, training, and energy-related knowledge amongst appraisers

Appraisal Industry by the Numbers



- Appraisers in the U.S.: **60,000**
- Estimated commercial appraisers: **12,000**
- Annual reduction in total workforce: **3%**
- Appraisers over 50 years old: **62%**
- Appraisers who are sole proprietors: **62%**
- Appraisers not belonging to any professional association: **66%**

Working Group

Commercial Real Estate:

- CB Richard Ellis
- Colliers International
- Connecticut Green Bank
- Cushman & Wakefield
- Fannie Mae
- GRESB
- Home Innovation Research Labs
- Inspyrod
- Institute for Market Transformation (IMT)
- LaSalle Investment Management
- Lawrence Berkeley National Laboratory (LBL)
- MetLife
- PNC
- Security National Mortgage Company
- US EPA (ENERGY STAR)
- USGBC
- View Glass

Appraisal Industry:

- Akerson & Wiley
- DeLacy Consulting
- Earth Advantage
- Runde & Partners, Inc.
- Sustainable Values, Inc.
- The Appraisal Foundation (TAF)
- The Appraisal Institute (AI)

The Appraisal Process

Identify the Need for Appraisal and Valuation

Define Scope of Work

Collect Property Data and Information

Analyze Property Data and Information

Apply Approaches to Value

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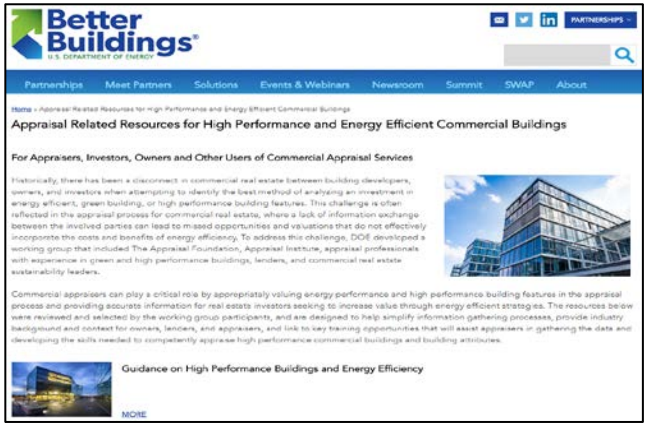
Working Group Accomplishments

- Guidance for Owners: Ordering Appraisals of High Performance and Energy Efficient Buildings
- Sample Scope of Work Language for Appraisers Valuing High Performance and Energy Efficient Buildings
- Online Appraisal Toolkit with tools, resources, and other information related to appraising green buildings
- Developed appraisal questions for the 2017 GRESB Debt Survey
- Upcoming: TAF APB Valuation Advisory for Green Commercial, Multifamily and Institutional Properties

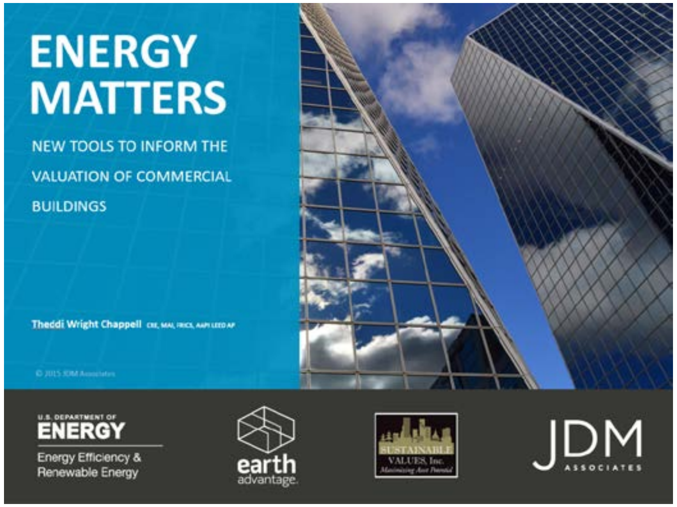


Solutions – NAREIM Group

- Large, influential owners
- Voluntary collaboration to address energy in the appraisal process
- Coordinating with Altus Group to revise scoping agreements
- Proposing greater emphasis on green and high-performance features during valuation
- Potential pilots to be conducted later in 2017

Solutions – *Energy Matters!* Training

- Emphasis on applying outputs from three federal tools:
    - ENERGY STAR Portfolio Manager
    - Building Energy Asset Score
    - Building Performance Database



- Designed to build upon existing resources, and fill gaps in current trainings
- Conducted live pilots
- Applied for IDECC online certification

Next Steps

- Promote toolkit and resources
- Engage GRESB to include appraisal questions on Equity Assessment
- Continue working with NAREIM ODCE index members to exert influence over appraisal communications and templates
  - Conduct pilot appraisals that incorporate new resources and emphasize valuation of green and high-performance building features
- Achieve IDECC certification for *Energy Matters!* and promote the training to appraisers
- Continue outreach and engagement efforts with lenders

Discussion

- Do you currently consider energy efficiency in your mortgages?
  - If yes, how?
  - If not, why not?

- What are the opportunities and barriers to applying these actions in your organization?
  - Who are key stakeholders needing buy-in?
  - How can DOE help?

Contact Us

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Thank You

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Appendix

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Ideal analysis approach

- Analysis on an empirical data set that has:
  - Time-variant data on energy factors for specific buildings
  - Loan performance data for the same buildings
  - A representative sample across different market segments

- *Challenges:*
  - *Lack of time-variant consumption dataset that can be matched with loan data*
  - *Lack of tariff data for individual buildings*

Energy price gap

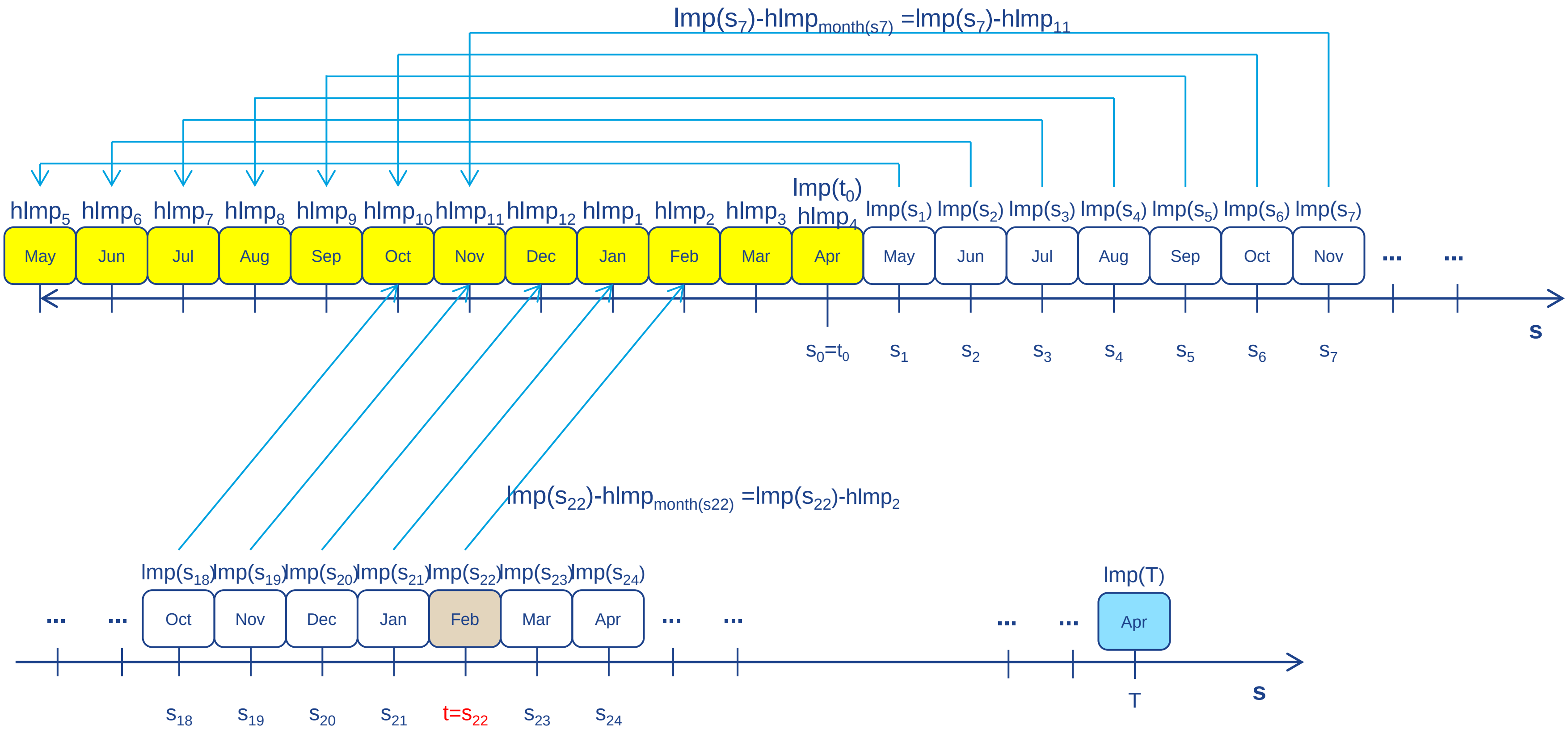
- Proxy for total unexpected energy expenditures
- Computed by summing monthly deviations of realized electricity prices from expected electricity prices at the time of mortgage origination
- Energy price gap, at time t, for a commercial mortgage originated at a time period t_0 within ISO zone k :

$$pgap_k(t_0,t) = \sum_{s=t_0}^{s=t} lmp_k(s) - hlmp_{k,month(s)}(t_0)$$

- Where:
  - *lmp* = monthly average on-peak locational marginal electricity price
  - *hlmp* = historical monthly average locational marginal price observed at the mortgage origination date.

Energy price gap

- Example: Evaluating the Energy Price Gap 22 months after the mortgage origination



Default risk and site EUI: Office and retail – linear prob. model

	Coefficient Estimate	Standard Error	Coefficient Estimate	Standard Error
Intercept	-0.05633	0.07404	-0.10734	0.08375
Log Site EUI	0.03169*	0.01711	0.02685	0.01658
Origination Loan-to-Value Ratio			0.0015**	0.00034
Coupon Spread to 10 Year Treasury			-0.00002	0.00014
Electricity Price Gap			0.00002***	0.00000
Time to Maturity on Balloon			-0.00048*	0.00028
Origination Year Fixed Effects/Year Fixed Effects	Yes		Yes	
N = 535 R2 = .002			N = 516 R2 = .0701	

* p<0.1; ** p<0.05; ***p<0.01

Default risk and site EUI: Office and retail – linear prob. model

- *Site EUI* is not statistically significantly different from 0 at better than .05 level.
- Electricity Price Gap is significant at better than the .05 level of statistical significance.
- Both coefficients have economically meaningful signs:
  - The higher the *Site EUI* (the more energy usage per square foot) the higher the likelihood of default.
  - The higher the *Electricity Price Gap*, (the larger the difference between the realized and the expected electricity prices since the loan origination), the higher the likelihood of default.

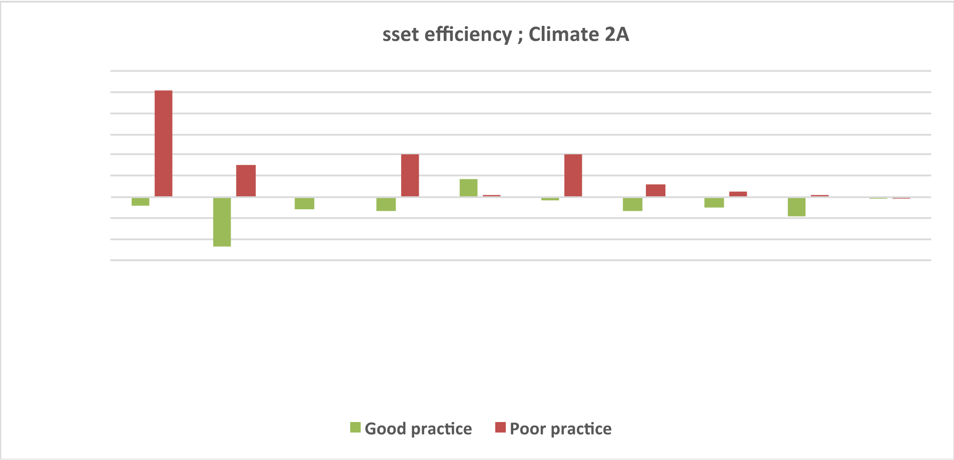
Default risk and ENERGY STAR Score: Office and retail – linear prob. model

	Coefficient Estimate	Standard Error	Coefficient Estimate	Standard Error
Intercept	0.18650**	0.05788	0.18383*	0.11046
Energy Star Score	-0.00102	0.00079	-0.00134*	0.00077
Origination Loan-to-Value Ratio			0.00183*	0.00099
Coupon Spread to 10 Year Treasury			-0.00028	0.00021
Electricity Price Gap			0.00004***	0.00001
Time to Maturity on Balloon			-0.00166**	0.00054
Origination Year Fixed Effects/Year Fixed Effects	Yes		Yes	
N = 448 R2 = .002			N = 432 R2 = .071	

* p<0.1; ** p<0.05; ***p<0.01

Default risk and ENERGY STAR score: Office and Retail – Linear Prob. Model

- *Energy Star Score* is not statistically significantly different from 0 at better than .05 level.
- Electricity Price Gap is significant at better than the .05 level of statistical significance.
- Both coefficients have economically meaningful signs:
  - The higher the *Energy Star Score* (the more energy efficient the building) the lower the likelihood of default.
  - The higher the *Electricity Price Gap*, (the larger the difference between the realized and the expected electricity prices since the loan origination), the higher the likelihood of default.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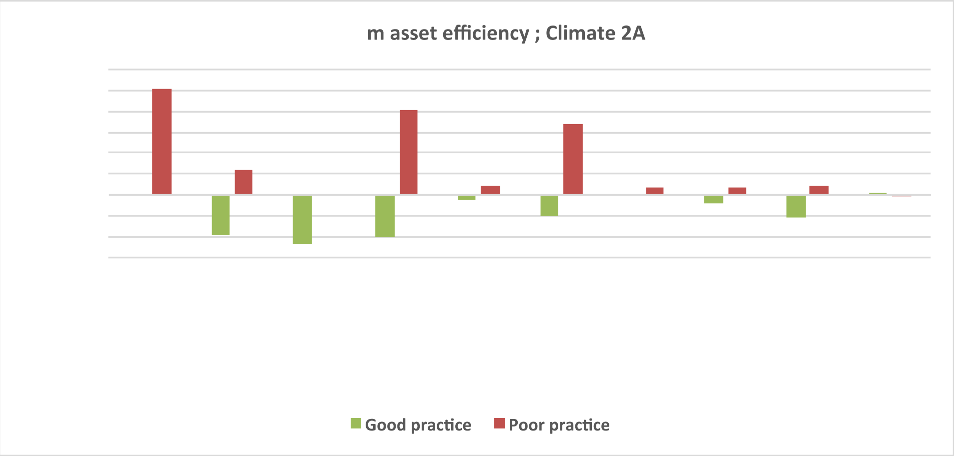
Good practice
Poor practice


High asset, 4A
tice (%)
Good practice
Poor practice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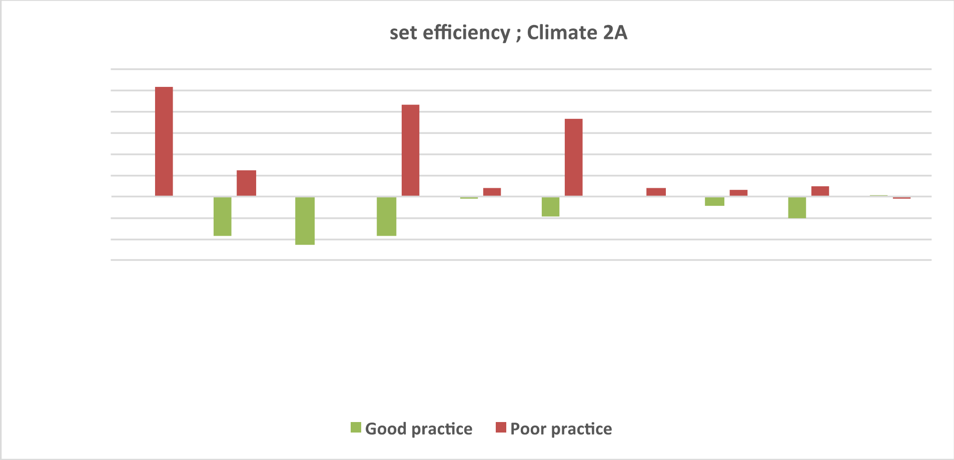
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set, 4A
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Range of variation due to weather: 2001-2015